

THE OPERATIONAL PREPAREDNESS OF UNITED STATES AIR FORCE
CERTIFIED REGISTERED NURSE ANESTHETISTS TO PROVIDE TRAUMA
ANESTHESIA

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ABSTRACT

The purpose of military medicine is to care for the injured during wartime. Military Certified Registered Nurse Anesthetists (CRNAs) must expand their role while deployed and be skilled in the management of trauma. Treating traumatically injured patients in Air Force hospitals is limited while working outside of the operational theater. The trauma anesthesia experience of United States Air Force (USAF) CRNAs is presently unknown. The purpose of this study was to determine the experience and training in trauma anesthesia of CRNAs in the United States Air Force, as well as their perceived value of this experience and training. For this study, a fifteen-question survey tool was developed and then reviewed by two CRNA experts for validity. IRB approval was obtained from both the Uniformed Services University of the Health Sciences and the USAF. Active duty CRNAs (N=269) were surveyed by mail about their length of time as a CRNA, the size of medical facility, the frequency of trauma cases, deployment experience to either combat or humanitarian missions, and trauma care experience outside of their military practice or during anesthesia education. The response rate was 60% (163/269). Data were analyzed using the Statistical Package for Social Services to describe the average trauma anesthesia experience of USAF CRNAs. The results showed that most USAF CRNAs have less than five years experience (109/163), and only 22% (37/163) have been deployed. Inadequate training with field anesthesia equipment was reported by 43% (16/37) of those who had been deployed. Twenty-five percent of the respondents practice trauma anesthesia in their military hospital with most doing less than 3 trauma cases per month. Twenty-two percent practice trauma anesthesia outside the military. This study found that CRNAs in the USAF highly value anesthesia experience in trauma centers, and ATLS courses.

Key Words: Trauma, Anesthesia, CRNA, Nurse Anesthetist, Battlefield Surgery, Combat Medicine.

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PREFACE

This research was conducted to provide information on the level of experience in caring for and providing anesthesia to patients suffering from severe injuries held by the Certified Registered Nurse Anesthetists in the ranks of the United States Air Force. It was intended to stimulate thought and discussion regarding the needs of those who may be forced to practice the science and art of anesthesia nursing while in harms way. It is the author s hope that the information gained from this study will ultimately serve those for whom we care as anesthesia providers.

DEDICATION

To those who have helped me get this far on my path through life; My father for inspiring me to never have a day just like any other, my daughter Melissa who keeps reminding me that dreams are the seeds of change, and my wife who brings joy to my heart.

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CHAPTER I: INTRODUCTION

Background

The responsibility of health care providers in the military is to care for the injured during times of conflict. From the field medic providing first aid, to the surgeon at the highest echelon, the mission of military medicine is to treat and care for the combat casualty and, if possible, return the combatant to duty quickly. This is what makes military medicine unique. The military anesthesia provider must transcend their traditional role while deployed in field hospitals and must be well versed in the management of trauma (Bellamy, 1995). To this end, the anesthesia provider needs to be trained and experienced.

Certified Registered Nurse Anesthetists, (CRNAs) of the United States Air Force (USAF) bring a great deal of training and knowledge to their specialty. However, trauma anesthesia is a specialty of its own, and focuses on the management of the airway, resuscitation, stabilization, and delivery of high-quality anesthetic care often under dangerous circumstances (Barton & Beeson, 1997). With the exception of those providers practicing at USAF Wilford Hall Medical Center, a recognized level-one trauma center in San Antonio, Texas, the experience of treating traumatically injured patients is limited.

It is presumed that the majority of surgical cases within the continental USAF medical facilities are usually routine, elective cases not resulting from traumatic injury. This is contrary to the type of cases seen during any armed conflict, whether it is a declared war or a result of aggression encountered during peacekeeping missions such as those recently undertaken. Bellamy (1995) has shown that ninety percent of combat casualties suffer penetrating injuries distributed to the head, face, and upper thorax. These injuries present distinct problems ranging from securing an adequate airway to obtaining venous access for circulatory resuscitation.

This difference in the types of cases usually cared for by the anesthesia provider

and the type of cases anticipated during a conflict presents a serious question. Is the anesthesia provider who cares for routine elective surgical cases adequately prepared to care for the injured combatant? A familiar maxim presents the concept that during emergencies and times of crisis, few people rise to the occasion and perform unexpected heroics. However, most others will default to the level of their training and experience. Therefore, it is imperative that the anesthesia provider responsible for caring for combat casualties be expert in the field of trauma care.

Anesthesia has been given on the battlefield in the care of combat casualties since Dr. E.H. Barton, surgeon of the 3rd Dragoons, Cavalry Brigade, Twiggs Division, first administered ether in the spring of 1847 during the Mexican-American war (Aldrette, Marron, & Wright, 1984). From that time, the need for highly experienced anesthetists has been recognized. Eighty thousand anesthetics were administered during the American Civil War (Barton & Beeson, 1997). Flagg (1918) demonstrated the importance of having combat anesthesia specialist at the front during World War I in his report to the Surgeon General. This same admonition has continued through to modern times with Bowen and Bellamy (1988) in the NATO Handbook of Emergency War Surgery stating:

In order to achieve the best results in emergency surgery for battle wounds, anesthetic management must be provided by thoroughly trained anesthesiologists and nurse anesthetists. Therefore, it is imperative that the most experienced anesthetists available are assigned to the forward surgical units in which lifesaving procedures are accomplished. In these instances, the choice and application of anesthesia carry the greatest risks and can be the most dangerous factors in that individual's total care (p. 215).

The need for trauma experience, mobilization and operational readiness was recognized and an attempt to provide greater trauma experience to U.S. Air Force

medical personnel was made through the development of Medical Red Flag exercises and Battlefield Medicine courses in 1979 (Yarington, 1985). Each of these courses has an objective of wartime medical training. However, the major weakness of these courses was identified as the relative lack of practical exercises and the opportunity for surgical or medical skill development.

Purpose of Study

The purpose of this study was to identify the experience of CRNAs in the United States Air Force in caring for trauma patients and combat casualties. This study also determined how USAF CRNAs valued their deployment training and experience.

Research Questions

1. What is the experience and training in trauma anesthesia of CRNAs in the United States Air Force?
2. How do CRNAs value this experience and training in their preparation for possible deployment?

Conceptual Framework

McAuliffe (1993) developed a conceptual framework of nurse anesthesia education, which she attributes as being based on the theoretical underpinnings of Weinstein, Paris, Gott, Dreyfus and Dreyfus, Flavel, Brown, Schon, Spiro and Vygotsky. In this model, McAuliffe states that the best way to learn and instruct others is by a method of case based instruction. In other words; if cases come in many forms, one needs to see many cases.

There are seven themes to McAuliffe's (1993) theory. The first is the avoidance of oversimplification and over regularization. The second is that knowledge that is to be used in many ways has to be learned, represented, and tried out in many ways. Theme three is that there must be a centrality of cases. In an ill structured domain with a great variability of cases, general principles will not capture the dynamics of each case and allow integration of knowledge based on the reasoning from preceding cases. Conceptual knowledge is knowledge in use is the fourth theme comprising McAuliffe's theory. This

theme usurps the idea of utilizing protocols or pre-packaged prescriptions. Instead, greater weight must be given to activating concepts in the new case by examination of resemblances across features of past cases that have been recalled. Theme five, schema assembly, calls for the replacement of rigid knowledge structures by flexible recombinable knowledge structures. In theme six, the non-compartmentalization of concepts is highlighted. The student must strive for multiple interconnectedness of cases and concepts along multiple conceptual and clinical dimensions. The seventh and final theme is active participation. There must be active learner involvement in knowledge acquisition accompanied by opportunistic guidance and expert mentors in order for the learner to derive maximum benefit from his or her explorations.

The model of nurse anesthesiology education (see Fig. 1) illustrates how, through case based clinical instruction, the three major components of knowledge (declarative, procedural and conditional), illustrated by spheres, progressively overlap in a three-staged developmental fashion. The didactic education of the anesthesia provider is aimed at maximizing the amount of knowledge within each of these spheres. The more information retained in each area gives the individual a greater foundation on which to base clinical practice. The convergence of these spheres of knowledge is initiated and sustained by repeated experiences. It is only through case-based instruction (represented by the crossed lines in the center of the circles) that nurse anesthesia students can integrate the three knowledge bases required for the practice of nurse anesthesia. With each new and successive experience, the overlap of these knowledge spheres expands. The model has five stages (Novice, Competence, Proficient, Expert, and Master). Nurse anesthesia students upon successful completion of an educational program will have completed stage three; proficiency. It is at this stage that they can, after passing the national certification examination, independently and safely administer anesthesia. These are entry level nurse anesthetists. Some nurse anesthetists, content in their proficiency, will never progress from this stage. Those who are content to practice at this stage will

not keep abreast of new developments in the field and their knowledge base will quickly dwindle. Fortunately, most graduates will desire to continue to learn more about the art of and science of nurse anesthesia and will progress to become expert nurse anesthetists. Expert anesthetists are confident and secure in their practice because they possess excellent clinical and decision making skills. Through continued study, they maintain a current nurse anesthesia knowledge base. Some, not all, will continue on to achieve the fifth stage, master . Those who achieve this stage of professional development have advanced their understanding of anesthesia, usually through intensive study in a specific area. These are the nurse anesthetists who often advance the science of nurse anesthesia by teaching, writing or conducting research (McAuliffe, 1993).

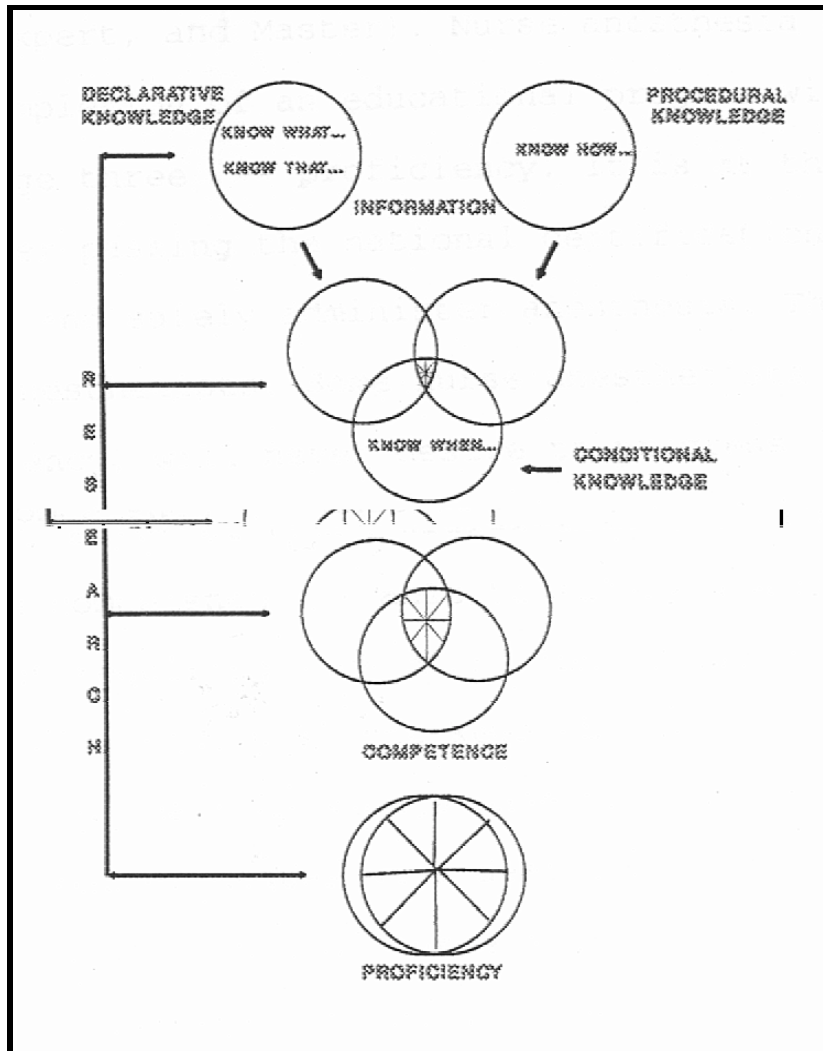


Figure 1. A Model for Nurse Anesthesiology Education
(Used with permission.)

Conversely, if the individual does not continue to gain exposure to new experiences, he or she may regress to merely being competent. This may be displayed in areas of specialization. An individual may be an expert in the provision of adult cardiac surgery anesthesia but may be minimally competent to provide pediatric anesthesia.

Definitions

The following terms and their definitions will be used in this study.

Anesthesia provider

Anesthesia provider refers to any active duty Air Force CRNA credentialed to provide anesthesia services within United States Air Force medical facilities.

Trauma

Any penetrating or blunt force injury to the victim that presents potential risk of death or loss of body function. Specifically for the purposes of this study, trauma refers to a multi-system injury requiring surgical intervention within twelve hours to save life or limb.

Combat casualty

A victim of traumatic injury suffered on the battlefield.

Trauma care

Medical or surgical care to prevent death or loss of function initiated within the first twenty-four hours following injury.

Assumptions

The assumptions of this study are:

1. Anesthesia providers within the USAF are competent and qualified to provide anesthesia
2. Trauma anesthesia in USAF medical facilities is limited.
3. The anesthetic and perioperative management of trauma patients is a specialty requiring special skill and training.
4. Responses to the survey tool accurately reflect the experiences of the

respondents.

Limitations

The limitations of this study are:

1. The trauma anesthesia skill level of the respondents has not been observed.
2. The respondents may subjectively enhance experience.

Summary

The practice of trauma anesthesia in the combat environment is unique. The need for trained anesthesiologists experienced in trauma care to provide anesthesia services and caring for combat casualties has been recognized since anesthetics were first administered on the battlefield. The special techniques, skills and considerations inherent to the practice of trauma anesthesia is enhanced through repetitive experience. Exposure to this experience is limited for those CRNAs practicing within USAF medical facilities. This study attempted to identify the trauma anesthesia training and experience of CRNAs.

CHAPTER II: REVIEW OF LITERATURE

The historical perspective of battlefield anesthesia and the role of Certified Nurse Anesthetists (CRNAs) has been described (Barton and Beeson 1997). The advancement of surgical intervention in caring for combat casualties over the ages has coincided with the evolution of nurse anesthesia in battlefield medicine. Nursing practices and their positive effect in improving patient care in various conflicts from the Napoleonic Wars, the Crimean, and American Civil War to the modern conflicts of Viet Nam and the Persian Gulf is well documented. General nursing care and the evolution of nurse anesthesia practice is provided with the description of the convergence during World War I, with the training of Army and Navy nurse anesthetists for war. The roles of nurse anesthetists in Viet Nam were vital in primary resuscitation and evacuation of patients in addition to the thousands of anesthetics provided. The contributions of nurse anesthetists in Operation Desert Storm were significant. The care of the war injured by nurse anesthetists has been described but the experience to treat trauma prior to deployment or the way in which anesthetists prepare to care for combat casualties has not been explored.

The need for experienced trauma anesthesia providers has been documented and the specialty of trauma anesthesia/critical care specialist has been defined (Grande, Stene, Bernhard and Barton, 1990; Stene and Grande 1991). The model for training is designed as a fellowship for the physician anesthesiologist. Additional specialty training is for CRNAs has not been developed. The additional training for the CRNA because the scope of nurse anesthesia practice parallels that of the anesthesiologist in the military. In addition to the supplemental knowledge and experience required to care for the traumatically injured patient, the trauma anesthetist must also be resourceful and adept at working in austere environments with less than optimal equipment. Baskett (1990) described situations that would require the anesthesia provider to practice what is considered field anesthesia using unsophisticated equipment in an austere environment.

In addition to the military environment, situations may include practice within an isolated community or the actual on-scene care and release of an entrapped victim. The techniques and equipment described by Baskett have their roots in battlefield medicine. He stated that Field anesthesia can be practiced safely and effectively but requires special training to acquire familiarity with the techniques. Skill should be maintained by practicing the appropriate techniques on a regular basis (p.23).

In addition to calling for the most experienced anesthesiologists available to be assigned to forward surgical units, Bowan and Bellamy (1988) stated that the harsh environment imposed by the tactical situation or geographical location impacts on the care given to the trauma patient. This environment may demand innovative applications to assure that the patient receives adequate anesthesia care. The anesthesiologist's ability to function in this environment is dependent on their experience and capacity to adapt. The anesthesiologist must have experience with the use of field anesthesia equipment such as the draw over vaporizer and intermittent flow machines to be competent in this environment.

Anecdotal descriptions of austere environments and the need for ongoing training and experience in resuscitation and intensive trauma anesthesia care have been described over the past decades. From personal experiences at a field hospital during the Yom Kippur War, Davidson and Cotev (1975) described the use of anesthesia providers in resuscitation, evacuation, and intensive care, and the administration of anesthesia. They concluded that surgical anesthesia for war casualties should be managed by providers with experience in the treatment of trauma. Bull (1983) and Jowitt (1984) described the role of anesthesiologists with the Royal Army and Navy during the Falklands War where nearly one thousand anesthetics were provided. The same type of anesthesia equipment used during the Falklands War is in use today. According to these authors, anesthesia providers need training with field anesthesia equipment and experience in caring for trauma patients.

Brock-Utne (1992) described the field anesthesia equipment, specifically the draw

over vaporizer anesthesia machine. He notes that the distributors of the draw over vaporizer, as well as the U.S. Food and Drug Administration, do not allow the equipment to be used on humans in North America when conventional anesthetic equipment is available. The draw over vaporizer is a primary tool in the anesthesiologist's armament when providing field anesthesia. However, nearly all anesthesia providers have never had the experience of using this equipment.

Some authors suggest that military anesthesiologists obtain trauma experience working in civilian trauma centers. Inferring that high-crime urban areas are analogous to the battlefield, Donchin, Wiener, Grande and Cotev (1990) recommended that sophisticated trauma centers be used to gain the needed experience of triage, resuscitation, airway management skills and monitoring of the severely injured patient. This may be practical but it must be kept in mind that while the principles of treating trauma are universal, the prevalence of traumatic mechanisms differs from the civilian to the combat environment. Blunt force trauma has been found to be the most important source of injury for civilians, while trauma inflicted during combat was overwhelmingly penetrating in nature (Bellamy, 1995). Additionally, the anesthesiologist treating trauma patients in the sophisticated trauma unit is not facing the severe conditions inherent to the battlefield. Although the patient encountered in such a facility may have disastrous injuries, the anesthesiologist still has modern equipment with which to care for and monitor the individual as well as resources to call upon for assistance. For this reason, Olsen (1997) contended that military anesthesiologists should be deployed to developing nations to take part in humanitarian missions which would provide an opportunity to work in harsh conditions using field anesthesia equipment in a pre-conflict, non life-threatening situation. Olsen also made the point that the military anesthesiologist's weapon platform is the field operating room, full of equipment and facility limitations that most anesthesia providers have not experienced. (p.76). By practicing their skills while deployed on humanitarian missions, providers would learn the weapon prior to its deployment, a concept that our line

counterparts realized long ago. (p.76).

With regard to the current operational training which focuses on gaining logistical training but does not provide or allow for real-life health care delivery, Olsen (1997) drew an analogy of the infantryman going to the rifle range, given a weapon and ammunition and told to envision his ability to use them. Increasing the reality of the training by providing actors with moulaged injuries portraying patients is metaphorical to the rifleman using a water pistol to shoot his target; no one gets hurt, operational effectiveness is marginally improved, and everyone shoots a perfect score in their own minds. (1977, p.78). This lack of practical exercise and the opportunity for surgical or medical skill development have been recognized as limitations of the U.S. Air Force's Medical Red Flag, Battlefield Medicine and the joint forces Combat Casualty Care Course (C-4) since their inception (Yarrington, 1985). This is substantiated by Gebicke (1993a) who states base level training exercises were often too short and that only small portions of deployable hospitals with limited supplies and field equipment are used or tested.

The American College of Surgeons (1984) Advanced Trauma Life Support (ATLS) course is a nationally recognized training program for the management of trauma. The course is targeted toward physicians who do not deal with major trauma on a daily basis. The management objectives of the training being rapid, accurate assessment of the patient's condition; provision of resuscitation and stabilization on a priority basis; the determination if a patient's needs exceed the capabilities; and that optimum care is provided with each step. The ATLS course is dedicated to the first hour of management of patient care, starting at the time of injury and continuing through initial assessment, life saving intervention, re-evaluation, stabilization and transfer to another facility. Although the ATLS concept is civilian in nature with the expectation that care will be carried out in a hospital emergency department, it does parallel the military medicine concept of immediate treatment, stabilization, and evacuation to a higher echelon of care.

The Combat Trauma Life Support (CTLS) course adopted by the Israel Defense Forces Medical Corp. is a teaching program of battlefield medicine based on the ATLS course. Additionally, exercises tailored to the demands of battlefield medicine were incorporated to bridge the gap between the civilian nature of ATLS and combat care. Blumenfeld, Kluger, Abraham, Stein and Rivkind (1997) performed a retrospective comparison of pre- and post -test performance scores of twenty-six hundred Israeli physicians who participated in the ATLS and CTLS courses. The purpose of their study was to compare the cognitive knowledge achievements of course participants and to delineate the impact of the course type on student s test results. The analysis indicated that participants who undertook the CTLS course achieved statistically better scores than those who did not take the course. The authors concluded that the CTLS curriculum provided improved training for battlefield trauma care support. This supports the concept that exposure to scenarios that mirror the conditions and limitations of combat anesthesia care improve the knowledge and performance of the provider.

The general lack of exposure to field conditions and the necessary improvisational skills required by the environment as well as the lack of experience in trauma care are exemplified in reports of medical care and lessons learned from Operation Desert Storm. Heatherington (1992) described his experience stationed with a U.S. Marine Corps collecting and clearing company which was a second echelon level of care. He discussed the use of the model 885 field anesthesia machine and its dependence on compressed gas. When military supply lines were over-stretched and the delivery of gas cylinders was delayed, the machine was out of service. He also pointed out that it was difficult to provide warm fluids and that patient hypothermia was a significant problem. He suggests that some type of microwave oven or heater (p.152) be deployed to overcome this difficulty. There is no substitute for experience, the ability to adapt, and the application of sound physiological principles for trauma patients (p.155).

Gebicke (1993a) in his reports to Congress, stated that much of the equipment in the

presently deployed hospitals was manufactured in the 1970 s and 1980 s. Many of the personnel had never trained with the equipment prior to arriving in theater. This lack of training contributed to a lack of confidence in the quality of equipment . and belief among medical staff .that they would have provided less than adequate care (Gebicke, 1993b, p.7). He also pointed specifically to the lack of training and experience in caring for trauma victims as an operational deficiency. Although the physicians and nurses who deployed were described as experienced and competent, many of them had never treated trauma patients .and a majority of them had not completed training in combat casualty care . Twenty-one lessons learned addressed deficiencies associated with training on equipment, specialty skill proficiency and battlefield preparedness.

Summary

Trauma, as a disease, requires specific care and treatment. Those who have a base of knowledge and experience to draw on can best provide trauma anesthesia care. The battlefield trauma is distinct and the environment in which combat casualties are cared for is harsh and foreboding. There is a need for specialized anesthesia care in these battlefield conditions. Greater experience in trauma anesthesia care while working in less than favorable conditions may lead to improved outcomes in providing anesthesia to the injured combatant.

Although the shortfalls of medical care during recent conflicts have been well documented, there is little written specific to anesthesia care. The purpose of this study was to identify the level of trauma experience and training held by USAF CRNAs. Additionally, the value of training and experience identified by this population of providers, as well as their perceived operational readiness was determined.

CHAPTER III: METHODS

Introduction

This was a descriptive study on the training and experience related to trauma anesthesia care among the population of Certified Registered Nurse Anesthetists (CRNAs) in the USAF. It described characteristics common to this population. Certain facts were assessed such as the length of anesthesia practice both within the military and in the civilian sector, type of practice as it relates to trauma anesthesia, deployment history, and field anesthesia equipment used. Additionally, the type of exposure to trauma anesthesia training and on-going education was determined. The providers opinions and attitude regarding the value of the various types of training and experience also were assessed.

Research Design

A survey questionnaire of fifteen questions (see Appendix A) developed for this study was mailed to all USAF CRNAs in January 1999. The names and military addresses for these individuals were obtained from the USAF Military Personnel Center. The questionnaire was included with a cover letter stating the purpose of the study and requesting the individual s participation. A self addressed stamped envelope was attached to facilitate return of the study questionnaire to the investigator. Collection of the surveys by return mail continued through May 15, 1999 when analysis was begun.

Measurement Tool

The survey questionnaire asked for demographic data, including length of time both as a CRNA and specifically as a military anesthetist. The size of facility in which the provider was working and the number of other providers associated with the practice were also requested

The respondent was asked if he or she had been deployed to battlefield conditions and if so, where. The type of equipment used during any deployment and training associated with that equipment prior to its use was questioned. The respondent also was

questioned regarding any humanitarian missions they may have participated in. The types of equipment used in these missions were requested.

To determine the amount and type of trauma anesthesia experience that providers bring to their military practice from the civilian sector they were asked if they practice outside of the military and if so, how many hour per month. They were also asked to indicate if this practice takes place in a designated Level II or higher trauma care center. Respondents were asked to indicate if they participated in a trauma anesthesia rotation during their residency training. Again, if this was answered in the affirmative the respondent was asked to indicate if this training took place in a Level II or higher trauma center.

Finally, the respondents were asked to provide their opinion as to the significance and value of various experiences that they may have accumulated in preparing them for their mission of providing anesthesia care in a combat environment. These experiences included civilian training, education, conferences, professional exposure, military training and readiness exercises, and actual deployment. Using a six point Likert scale to mark their responses, respondents were asked to rank their perceived value for individual experiences.

Two experts in the CRNA community reviewed the questionnaire to assure its validity prior to being distributed to the population. These individuals were selected for their expertise in trauma anesthesia care. The experts were asked to rate each item of the questionnaire using a four-point rating scale with the options being: 1 = Not relevant; 2 = unable to assess relevance without item revision or item is need of such revision that it would no longer be relevant; 3 = relevant but needs minor alteration; 4 = very relevant and succinct. Questions not having a rated score of 3 or above by both experts were to be eliminated or rewritten. All original questions met this standard and none had to be eliminated.

Protection of Human Rights

This study was conducted under the regulations, policies, and guidelines established by the Uniformed Services University of the Health Sciences (USUHS) and the United States Air Force. Approval for the study was obtained from the Institutional Review Board of USUHS; protocol # T06193, as well as from the Survey Control Branch, HQ AFPC; control number USAF SCN 98-83. Compliance with the standards and specification as set forth by both the University and the USAF was assured. Approval of the boards was obtained prior to the study.

Consent to participate in the study was inferred by the respondent completing the questionnaire and returning it to the investigator. Voluntary participation in the study was clearly delineated in the cover letter (see Appendix B). There was no attempt to coerce or influence participation. Participants in the study were not rewarded financially. There was no foreseen threat to the respondent's well being by completing the survey questionnaire. There was no encoded identifier attached to the tool and anonymity was maintained. The data collected did not involve sensitive information or deception of the subjects. The study sample was not seen to be vulnerable and had no relationship with the investigator. Two individuals known personally by the investigator returned handwritten notes either on or attached to the survey tool. These surveys were rejected and not included in the results of the study.

Data Analysis

The data was compiled and analyzed using the Statistical Package for Social Sciences (SPSS) software (1997). Preliminary data analysis included descriptive statistics such as the average length of anesthesia practice and duration of military anesthesia practice. The size and range of practice was averaged. Experience brought to practice was compared. The number of providers who have been deployed to combat scenarios was determined. Comparisons were made between the perceived value of preparation for deployment.

Summary

This descriptive study examined the amount of trauma anesthesia experience of USAF CRNAs. The study was performed by surveying the population by questionnaire to determine the amount of experience in providing trauma anesthesia care in this population. A determination of the deployed combat and humanitarian experience as well as the type of anesthesia equipment used during the deployment was made. The opinions of the respondents regarding the best way in which to gain experience and preparation for the combat mission were obtained.

The study was carried out under the guidelines, policies and regulations of the United States Air Force and The Uniformed Services University of the Health Sciences to assure the protection of human subjects.

CHAPTER IV: RESULTS

The results of this study are based on the answers of 163 respondents to a survey mailed in January 1999 to 269 USAF CRNAs on active duty. This represents a 60 % response rate. Surveys were collected through March 1999 and the data obtained were analyzed using SPSS to describe the operational training and trauma anesthesia experience of the CRNA force.

Demographic Data

Respondents to this survey reported an average of five years experience as a CRNA with a range of three months to twenty-five years. The largest percentage (66.9 %) of respondents had less than five years of military anesthesia practice. Five respondents (3.1 %) have practiced between fifteen and twenty years and three respondents (1.8 %) have been in military anesthesia practice for greater than twenty years. (see Table 1, and Figure 2.)

Table 1.**Military Anesthesia Practice Grouped In 5-Year Intervals**

Military Anesthesia Experience (Yrs)	N	Percent of Total
0 - 4.9	109	66.9
5 - 9.9	38	23.3
10 - 14.9	8	4.9
15 - 19.9	5	3.1
20 +	3	1.8

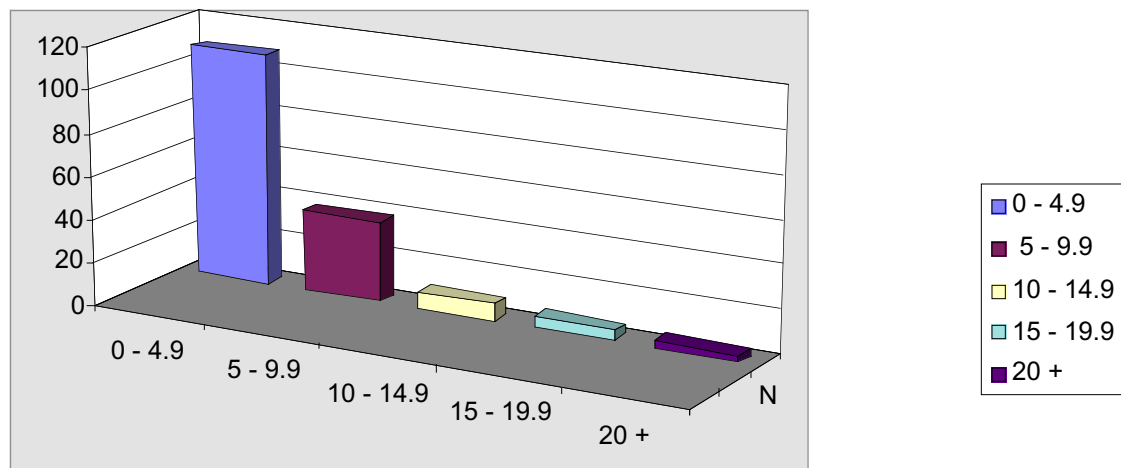


Figure 2.

Military Anesthesia Practice Grouped In 5-Year Intervals

CRNAs responding to the survey indicated working in USAF hospitals with one to twenty operating rooms in average daily service during 1998. The average number of working operating rooms per hospital was 5.1. The average numbers of CRNAs in practice at each facility was 8.6 with a range from one to thirty-four CRNAs in practice at each facility.

Deployment Experience

Twenty-two percent (37/163) of the respondents had been deployed to operational or combat areas as anesthesia providers. Table 2. indicates the number of providers according to years of service. Of those deployed, the largest percentage is made up of those with less than five years experience. This demonstrates that the number of deployed CRNAs with less than five years experience is relatively small and that those CRNAs with greater than ten years of military practice have nearly all been deployed.

Eighty-one percent (3/13) of CRNAs with greater than ten years of military anesthesia practice have been deployed (see Table 3.).

Table 2.

Deployed Military Practice Grouped in 5 Year Intervals

Length of			Percent of	Percent of
Military Practice:	N	Deployed	Total :	Deployed:
0 - 4.9	109	14	13%	38%
5 - 9.9	38	10	26%	27%
10 - 14.9	8	7	88%	19%
15 - 19.9	5	3	60%	8%
20 +	3	3	100%	8%
Total:	163	37		100%

Table 3.

Total CRNAs With Greater Than 10 Years Military Anesthesia Practice Deployment Experience.

Deployed?	N	Percent
Yes	13	81.3
No	3	18.7

Deployment Location and Equipment

The locations of deployment of the thirty-seven respondents who had been deployed are shown in Table 4. Most of the respondents were deployed to the Middle East. Fourteen of the respondents (37.9 %) had served in the Desert Shield / Desert Storm conflict. Two (5.4 %) had been deployed to Bosnia. The remaining 56.7 % had been deployed to various other locations including Panama, Korea, and Bahrain.

Table 4.**Deployment Location**

Deployment Location:	N	Percent
Desert Shield / Storm	14	37.9
Bosnia	2	5.4
Other:	21	56.7
Total	37	100

The thirty-seven respondents who had been deployed indicated that the Ohio Model 88-5 field anesthesia machine was the most common machine used during their deployment. Twenty-five (67.6 %) had used the 88-5 anesthesia machine. Four CRNAs (10.8 %) had used a draw over vaporizer to provide anesthesia, while six CRNAs (16.2 %) had provided anesthesia during their deployment using both a draw over vaporizer and a Model 88-5 anesthesia machine while two providers stated that they had used other unidentified type of equipment. (see Table 5.).

Table 5.**Field Equipment Used In Deployment**

Equipment	N	Percent
Ohio Model 88-5		
Field Machine	25	67.6
Draw Over Vaporizer	4	10.8
Both	6	16.2
Other	2	5.4

Of the thirty seven respondents who had provided anesthesia using either the

Model 88-5 anesthesia machine or the draw over vaporizer, sixteen (43.2 %) stated that they had not been adequately trained on the equipment prior to deployment. Comments regarding the lack of training included the first time I had seen the unit or training was limited to on-the-job. Twenty-one of the respondents (56.8 %) stated they had indeed been trained appropriately prior to having to provide anesthesia using the equipment.

Humanitarian Missions

The opportunity to practice trauma anesthesia in hostile environments does occur with humanitarian missions. For this reason, the survey asked for experience in such missions. Fourteen of the respondents (8.6 %) indicated participating in humanitarian relief missions. These missions were to locations including Cuba, Mexico and the Honduras.

Trauma Anesthesia in Hostile Environments

Of the 163 respondents, only 13 (8.0 %) indicated they had practiced trauma anesthesia as during deployment or humanitarian missions (see Figure 3.). Most of the CRNAs responding to the survey had never provided anesthesia care to a trauma patient in a hostile environment.

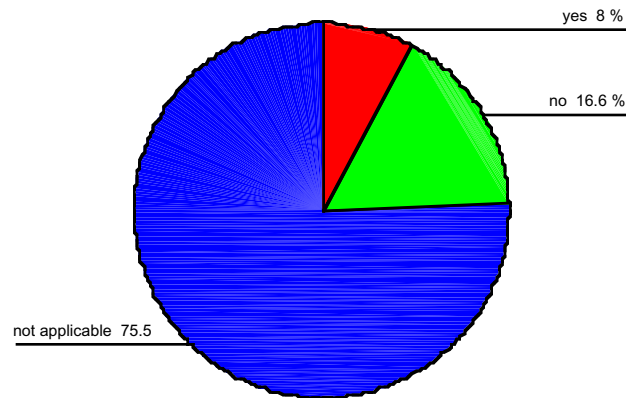


Figure 3.

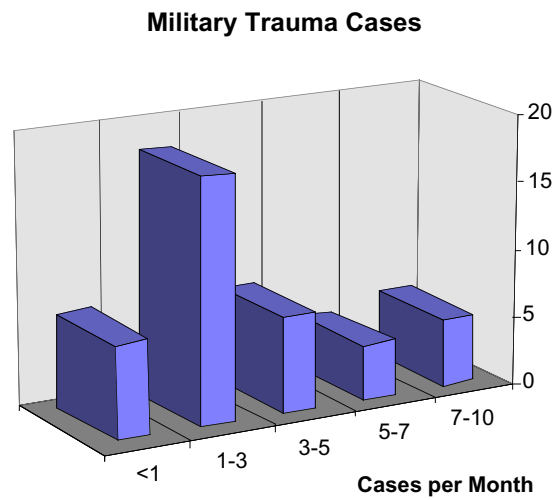
Trauma Anesthesia During Deployment or Humanitarian Mission

Military Trauma Anesthesia

Forty-one CRNAs (25.2 %) indicated that they practiced trauma anesthesia in their current military practice. Table 6 and Figure 4 demonstrates the number of monthly trauma cases seen in individual practices. Nearly forty-eight percent of those indicating that they provide trauma anesthesia do less than one trauma case per month.

Table 6.**Average Military Trauma Cases per Month**

Cases per Month	N	Percent
< 1	7	17%
1	13	32%
2	5	12%
3	3	7%
4	4	10%
5	1	2%
6	3	7%
7	1	2%
10	4	10%
Total	41	100%

**Figure 4.****Average Military Trauma Cases per Month.**

Trauma Anesthesia Practice Outside of the Military

The respondents were asked if they were practicing trauma anesthesia outside of the military, for example in a moonlighting role. One respondent did not answer the question and one hundred twenty-seven denied an outside trauma practice. Thirty-five (21.6 %) of the respondents are practicing trauma anesthesia outside of their military practice with an average of fourteen hours a month being practiced in Level I trauma centers and four and one half hours a month practiced in Level II trauma centers.

Training and Trauma Experience in Other Roles

One hundred thirty-four of the respondents (82.2 %) indicated they had a specific trauma rotation during their nurse anesthesia educational program. One hundred twenty-seven (77.9 %) had obtained this experience in a Level I trauma center (See Table 7.). One hundred seven (65.6 %) of those surveyed responded that they had cared for serious trauma victims in another role such as intensive care nurse, paramedic or emergency technician. The average experience associated with these other roles is 4.2 years.

Table 7.

Trauma Training Level

	N	Percent
Non Trauma Center	31	19%
Level I Trauma Center	127	78%
Level II Trauma Center	5	3%
Total	163	100%

Perceived Values of Experiences and Classes in Preparing to Provide Trauma Anesthesia.

The respondents were asked to give their perception as to the value of an experience or class in preparing them to provide trauma anesthesia in a hostile environment. These

classes included the Advanced Trauma Life Support class, the USAF Combat Medicine Course, the USA Combat Casualty Care Course, and the USAF field training exercises; Medical Red Flag, as well as trauma anesthesia conferences. Additionally, experiences such as deployment or humanitarian missions, civilian trauma care experience and other experience in non-anesthesia roles were compared. The respondents were asked to rank any class or experience that they had participated in on a scale of 1 = no value to 6 = extremely valuable. Any class or experience the individual had not participated in was ranked as 0 = Not Applicable. The respondents who had civilian trauma experience rated this experience as most valuable in preparing them for caring for combat injuries. This was followed by the American College of Surgeons Advanced Trauma Life Support training. Civilian trauma experience and ATLS were both rated above the level of very valuable. Experience in humanitarian missions, deployment, and non-anesthesia experience, as well as the US Army Combat Casualty Care Course and USAF Combat Medicine Course were rated between somewhat valuable and very valuable. The three day USAF Medical Readiness / Medical Red Flag course was rated as having little value (see Figure 5.).

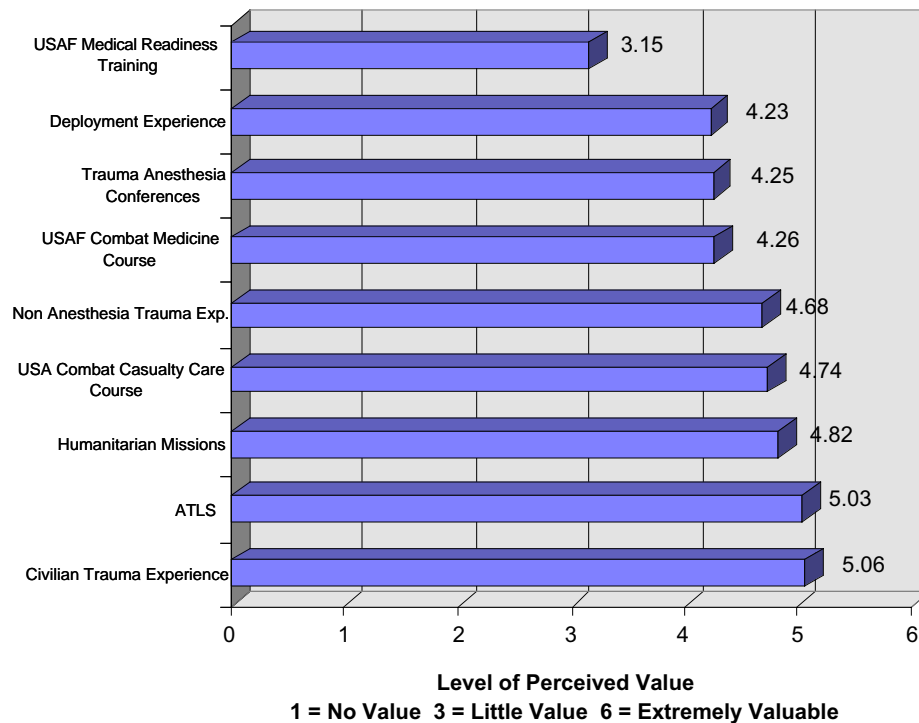


Figure 5.

Perceived Value of Training and Experience.

Summary

This survey of 163 active duty CRNAs in the United States Air Force showed that most anesthesiologists (66.9%) have been in practice for less than five years and work in small military treatment facilities with an average of five operating rooms in daily operation. Forty-one (25.2%) of the respondents practice trauma anesthesia in their military practice. However, the largest percentage of these individuals does less than one trauma case per month.

Twenty-two percent of the respondents stated that they had been deployed to a combat area and a smaller number had taken part in humanitarian missions. These individuals used the Ohio Model 88-5 field anesthesia machine or the draw over vaporizer. Forty-three percent of the respondents with field equipment experience indicated that they had not been adequately trained on the equipment prior to its use. Only 13 (8%) said that they had ever provided trauma anesthesia care during deployment or humanitarian missions.

Nearly 22% of USAF CRNAs currently practice trauma anesthesia outside of their military role. These individuals are gaining experience with trauma patients by spending an average of fourteen hours in level I trauma centers per month. A large percentage of respondents (82.2%) had accomplished a specific trauma rotation during their anesthesia training and 77.9% did their trauma anesthesia training at a level I trauma center. Nearly sixty-six percent of the respondents indicated that they had cared for serious trauma patients in roles other than that of an anesthetist.

When rating the experiences and training opportunities available to better prepare the anesthetist to provide trauma anesthesia during any future deployment on a six point scale, the respondents answered that civilian trauma experience and the American College of Surgeons Advanced Trauma Care Support class were very valuable. The USAF Combat Medicine course and the US Army Combat Casualty Care Course (C-4) as well as deployment, humanitarian, and non-anesthesia experience were rated between somewhat and very valuable, while the USAF Medical Readiness (Red Flag) was rated as having only little value.

CHAPTER V: CONCLUSIONS AND DISCUSSION

Introduction

The Certified Registered Nurse Anesthetist (CRNA) practicing in the United States Air Force (USAF) brings vast amounts of knowledge and experience to the clinical setting when caring for their patients. This is demonstrated daily in USAF hospitals and treatment facilities around the world. However, the majority of USAF CRNAs do not routinely care for acute trauma patients in their military practice. Trauma care has been defined as a distinct subspecialty of anesthetic care focusing primarily on airway management and fluid resuscitation, while delivering quality anesthesia to patients who are hemodynamically unstable. Air Force CRNAs must always be prepared to provide this high quality care under dangerous circumstances while in harms way. The purpose of this descriptive study was to evaluate and identify the amount of trauma care experience and operational training of USAF CRNAs currently on active duty.

Survey Results

Most CRNAs on active duty have less than five years experience in military anesthesia practice. There does not appear to be a large number of anesthetists with prior anesthesia experience. The average length of pay back required for military educational sponsorship either through direct training or through scholarships is approximately four to five years, indicating that most CRNAs in the USAF are only fulfilling their educational obligation and then leaving the military.

Many CRNAs work in small facilities with four to five operating rooms in daily service and have an average staff of seven to eight anesthetists assigned. One fourth of the respondents practice trauma anesthesia in their military practice. However, nearly half of these individuals do one or less trauma case per month.

The majority of anesthetists bring experience in caring for trauma patients in another role such as intensive care nurse to their anesthesia practice. They rate this

experience as being somewhat valuable in their perception as preparation to provide trauma anesthesia. Following the model proposed by Donchin and colleagues in their 1990 article, 22% of the respondents are currently gaining trauma experience and augmenting their practice while working an average of fourteen hours per month in Level I or Level II trauma centers outside of the military. While this experience is gained in controlled surroundings and a stable environment not truly analogous to the battlefield, it is the highest rated in the perception of value for preparing the anesthetist to provide trauma anesthesia and is considered by those individuals to be very valuable .

A small minority of the respondents had been deployed to combat areas. Those participating in hostile actions were deployed to campaigns of short duration with minimal casualties encountered. A smaller number of anesthetists had gained experience in field anesthesia while participating in humanitarian missions as suggested by Olsen (1997). While all of these anesthetists were faced with providing anesthesia in austere environments using unfamiliar equipment, either on the battlefield or in a relief mission, only a small number of these individuals actually provided trauma anesthesia to seriously injured patients. Those who have provided trauma care in a hostile environment represent only eight percent of the total USAF CRNA force. This may account for the perception that these experiences were rated as only between somewhat valuable and very valuable in preparing to care for future trauma patients.

A significant number of USAF anesthetists who have practiced anesthesia in field settings voiced a lack of familiarity with the equipment they found themselves using. This supports the comments of Gebicke in his 1993 congressional report that many personnel had not been adequately trained to use the equipment found in the field.

CRNAs who have participated in various training courses rated these in order of their perceived value in preparing to provide trauma anesthesia. The American College of Surgeons Advanced Trauma Life Support class was rated nearly as high as current trauma experience in its value to preparing the anesthetist to provide trauma anesthesia

and was considered between very valuable and extremely valuable. The United States Army Combat Casualty Care Course was rated slightly higher than the Air Force's Combat Medicine Course and trauma anesthesia conferences but all were perceived to be between somewhat and very valuable in preparation to provide trauma anesthesia. Perceived as being of little value to actually preparing the anesthetist to provide trauma anesthesia was the USAF medical readiness / Red Flag training. This was not surprising as this course is intended to indoctrinate the participants to the logistics and operations of a field hospital but does not incorporate patient treatment into its objectives.

This study was supported by McAuliffe's 1993 conceptualization that the convergence of declarative, procedural and conditional knowledge is initiated and sustained by repeated experience. Although United States Air Force CRNAs have a wide knowledge and experience base, it appears from this survey that specific trauma care experience is limited. The majority of CRNAs have accomplished a trauma clinical rotation during their education but have not been exposed to repeated experience through their military practice.

Military Relevance

This study reveals a significant discontinuity in the ability of the USAF to provide the highest level of anesthesia care to the patients wounded on the battlefield. In the event of a deployment to combat areas, today's CRNA may face trauma anesthesia care with minimal experience and training. Complicating this scenario will be the unfamiliar equipment the CRNA may use and the harsh environment they may practice in.

The training objectives for active duty CRNAs should be directed at resolving this gap between the anesthetist's daily expertise and the required abilities of their potential mission. The combatant receiving care in a battlefield hospital should be able to expect the same high quality of care they would receive in any USAF treatment facility in the continental United States. For this expectation to become reality, trauma anesthesia care training and experience may need to be compulsory.

This type of experience can be acquired through many avenues. Those working in trauma centers have indicated the value that this experience has provided to their perceived ability to deliver trauma anesthesia. Temporary out placement of USAF CRNAs to urban Level I centers for regular training and exposure to high velocity penetrating trauma can provide an ever-increasing knowledge base regarding the physiological treatment and anesthesia care of trauma patients. Participating in humanitarian relief missions both at home and abroad can provide the anesthetist with experience in working in remote, non-controlled settings.

Advanced Trauma Life Support provides excellent trauma training for all anesthetists. It is now offered only to physicians. This course or a military correlation would be just as valuable to USAF CRNAs whose military scope of practice parallels anesthesiologists. Additional training directed at battlefield scenarios may also be accomplished through such programs as the Army's Combat Casualty Care Course.

Limitations of the Study

This study was based on the responses of those self-enrolling in the study. While the survey was distributed to the entire population of USAF CRNAs, there was no way to encourage those receiving the tool to respond. Additionally, there was no way to assure that the responses accurately described the individual's actual experiences. Although the tool was screened by experts for clarity, perceptions of statements or definitions cannot be ensured.

The survey was distributed and collected at a time of moderate operational tempo within the force. As world events subsequently evolved and affected the operational tempo, the responses to some questions may have been modified.

Suggestions for Future Studies

Quantification of patient outcomes based on the study of those anesthesia providers with varying degrees of trauma experience has not been accomplished. While this may be ethically difficult to accomplish with prospective studies of living trauma patients,

retrospective studies may provide insight to the level of care provided by anesthesiologists with varying levels of experience.

Certain scenarios may be developed and studied using the recent generations of patient simulators. Comparison of the abilities of anesthesia providers with stratified levels of trauma care experience and the correlation of patient outcome could then be made.

Replications of this study describing the trauma care experience of CRNAs in the US Army and Navy may be useful to these services. Policy decisions for further training and education of military CRNAs could then be developed on stronger science based information rather than anecdotal opinion.

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APPENDICES

Appendix A: Questionnaire

Appendix B: Cover Letter

Appendix A: Questionnaire

Training and Experience in Trauma Anesthesia Questionnaire

The purpose of this study is to identify experiences of Certified Registered Nurse Anesthetists in trauma anesthesia and to measure the value of their experience in preparation for deployment. For the purpose of this study, trauma is defined as a multi-system injury requiring surgical intervention within twelve hours of initial injury to save life or limb.

1. Branch of Service: (1)Army____ (2)Navy____ (3)Air Force____
 2. Date of CRNA certification: ____/____
Month Year
 3. Years in military anesthesia practice: ____
 4. Does your military practice include trauma anesthesia? Yes(1)____ No(2)____
A) If so, please indicate the average number of trauma cases per month: ____
 5. How many operating rooms were in normal daily service at your facility in 1998? ____
 6. How many anesthesia providers normally practice at your facility? CRNA(1)____ MDA(2)____
 7. Have you ever been deployed as an anesthesia provider? Yes(1)____ No(2)____
 8. If you have been deployed as an anesthesia provider, please indicate where:
 A) Viet Nam (1)____ D) Panama (4)____
 B) Grenada (2)____ E) Desert Shield/Storm (5)____
 C) Bosnia (3)____ F) Somalia (6)____
 G) Other (7)____
 9. During any deployments, which field anesthesia equipment did you use?
 A) Model 88-5 Field anesthesia machine (1)____
 B) Draw over anesthesia vaporizer (2)____
 C) Other (3)____
 10. Were you adequately trained on the equipment you used during your deployment prior to deployment? Y(1)____ N(2)____
 A) Please indicate the shortfalls in your training: ____
 11. Have you participated in any humanitarian missions, providing anesthesia? Y(1)____ N(2)____
 A) If yes, where and when? ____
 12. During any humanitarian missions, which field anesthesia equipment did you use?
 A) Model 88-5 Field anesthesia machine (1)____
 B) Draw over anesthesia vaporizer (2)____
 C) Other (3)____
 13. Did you practice trauma anesthesia during your deployment or humanitarian missions? Y(1)____ N(2)____ NA (3)____
 14. Do you practice trauma anesthesia outside the military? Yes(1)____ No(2)____
 A) If yes, do you practice at a Level I trauma center? Yes(1)____ No(2)____
 Hours per month ____
 B) or, a Level II trauma center? Yes(1)____ No(2)____
 Hours per month ____
 15. Did your Nurse Anesthesia program include a clinical site rotation in trauma anesthesia?
 Yes(1)____ No(2)____
 A) If yes, was this at a Level I trauma center? Yes(1)____ No(2)____
 B) or a Level II trauma center? Yes(1)____ No(2)____
 16. Have you cared for serious trauma victims in any other role, i.e. EMT, Paramedic, Emergency Room RN, etc.?
 Yes(1)____ No(2)____
 A) If so, how many years did you practice? ____
 17. Please rank in order the following experiences or classes that you have participated in as to their value in preparing you to provide trauma anesthesia during future deployment. Please circle the corresponding number with 1 being little or no value, 6 being extremely valuable. If you have not participated in a class or previous deployment, please circle NA.
- | | No value | | | | Very valuable | |
|---|----------|---|---|---|---------------|------|
| A) Advanced trauma life support: | 1 | 2 | 3 | 4 | 5 | 6 NA |
| B) USAF Combat medicine course: | 1 | 2 | 3 | 4 | 5 | 6 NA |
| C) USA Combat Care Casualty Course (C-4): | 1 | 2 | 3 | 4 | 5 | 6 NA |
| D) Field training exercises / Medical Red Flag: | 1 | 2 | 3 | 4 | 5 | 6 NA |
| E) Civilian trauma care experience: | 1 | 2 | 3 | 4 | 5 | 6 NA |
| F) Trauma anesthesia conferences: | 1 | 2 | 3 | 4 | 5 | 6 NA |
| G) Previous deployment experiences: | 1 | 2 | 3 | 4 | 5 | 6 NA |
| H) Humanitarian mission: | 1 | 2 | 3 | 4 | 5 | 6 NA |
| I) Previous non anesthesia experience: | 1 | 2 | 3 | 4 | 5 | 6 NA |

Appendix B: Cover Letter

January 22, 1999

Dear U. S. Air Force Anesthesia Provider:

I am a student registered nurse anesthetist at the Uniformed Services University of the Health Sciences Nurse Anesthesia Program. I am conducting research for my thesis on the trauma anesthesia experience of Certified Registered Nurse Anesthetists (CRNAs) in the US Air Force. My research will look at the amount of trauma experience obtained by anesthesia providers during military duty. Additionally, I will question the level of trauma anesthesia training obtained during the initial preparation as a CRNA. Providers will also be asked to give their opinion on the value of various operational and educational opportunities in preparing them to provide trauma anesthesia during deployment.

Your assistance will be valuable to my research. Your participation will be limited to completing the enclosed questionnaire by filling in the blanks and returning it. This should not require more than fifteen minutes of your time. The questionnaire has no identifiable or traceable items and anonymity is assured. Your consent to participate in this research is voluntary and is implied by completing and returning the questionnaire. When answering the questionnaire, please keep in mind that for the purposes of this study, trauma is defined as a multi-system injury that requires surgical intervention within twelve hours of initial injury.

Should you have any questions regarding my research, please feel free to contact me at the Graduate School of Nursing/Nurse Anesthesia office; 301 295 6565 or the University's Office of Research; 301 295 3303 .

Thank you for taking the time to complete this questionnaire. Please return it to the above address by 1 March, 1999.

Sincerely,

Michael Frank, SRNA
Captain, USAF, NC